

CLAIMS

- [1] A light-emitting diode having a light-emitting element fixed to a leadframe with a conductive adhesive material, the light-emitting element having a semiconductor layer including a light-emitting layer laid on a first surface of a translucent substrate, of which a second surface facing away from the first surface is used as a light emission observation surface,
- wherein a side surface of the semiconductor layer is an inclined surface inclined relative to the first surface, and an angle between a normal to the inclined surface and a crystal surface on which the light-emitting layer grows is equal to an angle at which light emitted by the light-emitting layer is totally reflected toward the translucent substrate.
- [2] The light-emitting diode of claim 1, wherein the semiconductor layer has a first-conductivity-type semiconductor layer and a second-conductivity-type semiconductor layer formed by laying a first-conductivity-type compound semiconductor and a second-conductivity-type compound semiconductor in this order from a translucent substrate side so that the first-conductivity-type semiconductor layer and the second-conductivity-type semiconductor layer are adjacent to each other with the light-emitting layer sandwiched in between, with a vertical hole formed so deep as to penetrate the translucent substrate and reach the first-conductivity-type semiconductor layer but not to reach the second-conductivity-type semiconductor layer, and with a conductive material formed along the vertical hole so as to conduct to the first-conductivity-type semiconductor layer.
- [3] The light-emitting diode of claim 1, wherein the semiconductor layer has a first-conductivity-type semiconductor layer and a second-conductivity-type

semiconductor layer formed by laying a first-conductivity-type compound semiconductor and a second-conductivity-type compound semiconductor in this order from a translucent substrate side so that the first-conductivity-type semiconductor layer and the second-conductivity-type semiconductor layer are adjacent to each other with the light-emitting layer sandwiched in between, with an insulating member filling an opening formed in the second-conductivity-type semiconductor layer, with a vertical hole formed above the opening so as to penetrate the translucent substrate and the first-conductivity-type semiconductor layer, and with a conductive material formed along an inner wall surface of the vertical hall so as to conduct to the first-conductivity-type semiconductor layer.

- [4] The light-emitting diode of one of claims 2 and 3, wherein the vertical hole is closed by a pad electrode formed on the second surface of the translucent substrate.
- [5] The light-emitting diode of one of claims 2 to 4, wherein the vertical hole is increasingly small with increasing depth.
- [6] The light-emitting diode of one of claims 2 to 5, wherein the conductive material is translucent.
- [7] The light-emitting diode of one of claims 1 to 6, wherein the angle is in a range from 40° to 50°.
- [8] The light-emitting diode of one of claims 1 to 7, wherein the inclined surface is coated with an insulating film.
- [9] The light-emitting diode of one of claims 1 to 8, wherein the semiconductor layer is formed of a gallium nitride compound.